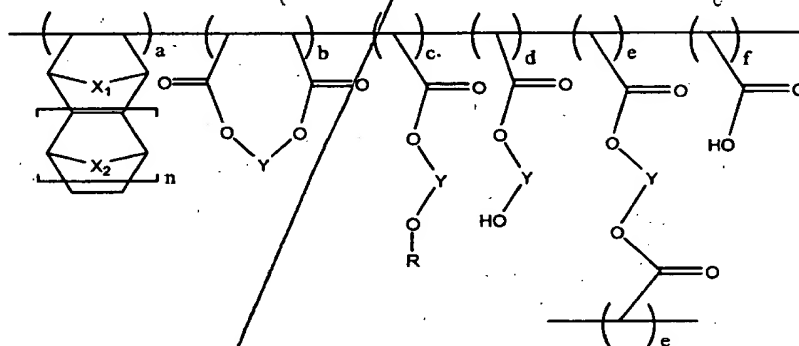


What is claimed:

1. A photoresist polymer comprising a repeating unit of following formula 1:

Formula 1



wherein, X<sub>1</sub> and X<sub>2</sub> are independently selected from the group consisting of CH<sub>2</sub>, CH<sub>2</sub>CH<sub>2</sub>, O and S;

Y is C<sub>1</sub>-C<sub>10</sub> alkylene or alkylene comprising an ether linkage;

R is an acid labile protecting group;

n is an integer from 0 to 2; and

a : b : c : d : e : f is 20-40mol% : 0-20mol% : 20-70mol% : 0-30mol% : 0-20mol% : 0-20mol%.

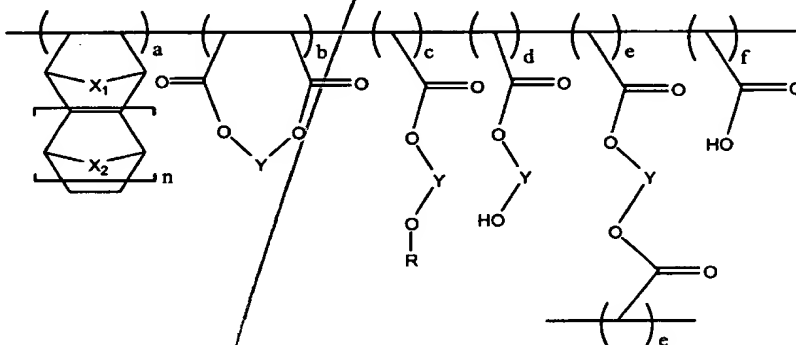
2. The photoresist polymer according to claim 1, wherein the acid labile protecting group is selected from the group consisting of tert-butyl, tetrahydropyran-2-yl, 2-methyl tetrahydropyran-2-yl, tetrahydrofuran-2-yl, 2-methyl tetrahydrofuran-2-yl, 1-methoxypropyl, 1-methoxy-1-methylethyl, 1-ethoxypropyl, 1-ethoxy-1-methylethyl, 1-methoxyethyl, 1-ethoxyethyl, tert-butoxyethyl, 1-isobutoxyethyl and 2-acetylmenth-1-yl.

3. The photoresist polymer according to claim 1, wherein n is 0,  $X_1$  is  $CH_2$ , Y is  $CH_2CH_2$  or  $CH_2CH_2OCH_2CH_2$ , and R is tert-butyl.

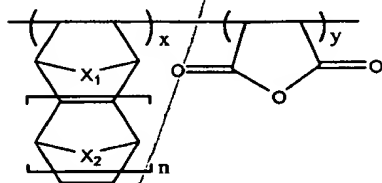
4. A process for preparing a photoresist polymer comprising:

- 5 (a) polymerizing a compound of Formula 5 with maleic anhydride to obtain a polymer of Formula 2;
- (b) reacting the polymer of Formula 2 with a diol compound of Formula 4 to obtain a polymer of Formula 3; and
- (c) reacting the polymer of Formula 3 with a compound having an acid labile protecting group to obtain a polymer of Formula 1 where a hydroxyl group is partially protected.
- 10

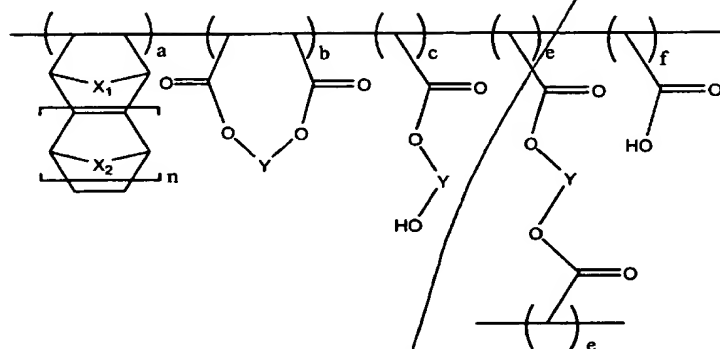
Formula 1



Formula 2



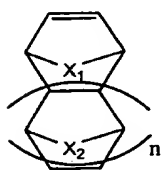
Formula 3



Formula 4

OH-Y-OH

Formula 5



wherein,  $X_1$  and  $X_2$  are independently  $CH_2$ ,  $CH_2CH_2$ , O or S;

Y is  $C_1$ - $C_{10}$  alkylene or alkylene comprising an ether linkage;

R is an acid labile protecting group;

n is an integer from 0 to 2;

in Formula 1, a : b : c : d : e : f is 20-40mol% : 0-20mol% : 20-70mol% : 0-30mol% : 0-20mol% : 0-20mol%;

in Formula 2, x : y is 20-40mol% : 60-80mol%; and

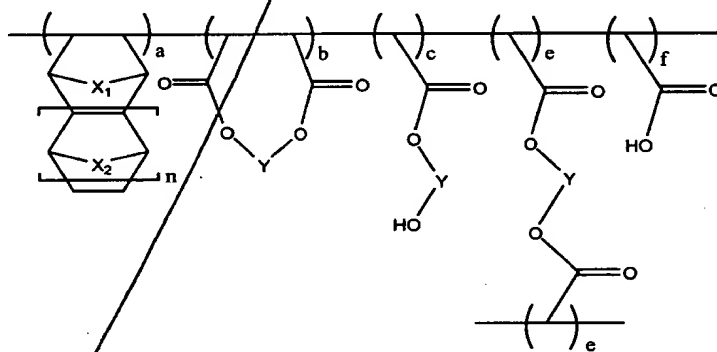
in Formula 3, a : b : c : e : f is 20-40mol% : 0-20mol% : 20-80mol% : 0-20mol% : 0-20mol%.

5. The process according to claim 4, wherein the acid labile protecting group is selected from tert-butylcarboxylate, ( $C_1$ - $C_{20}$ ) alkyl, aryl or arylvinylether.

6. The process according to claim 4, wherein the polymerizing is carried out in a polymerization solvent selected from the group consisting of tetrahydrofuran, dimethylformamide, dimethylsulfoxide, dioxane, benzene, toluene, xylene and mixture thereof.

7. An intermediate compound represented by following Formula 3, which is used to prepare the repeating unit of claim 1.

Formula 3



wherein,  $X_1$  and  $X_2$  are independently  $CH_2$ ,  $CH_2CH_2$ , O or S;

Y is  $C_1$ - $C_{10}$  alkylene or alkylene comprising an ether linkage;

n is an integer from 0 to 2; and

a : b : c : e : f is 20-40mol% : 0-20mol% : 20-80mol% : 0-20mol% : 0-

20mol%.

8. A photoresist composition comprising (i) the photoresist polymer of claim 1, (ii) a photoacid generator; and (iii) an organic solvent.

9. The photoresist composition according to claim 8, wherein the photoacid generator is selected from the group consisting of phthalimidotrifluoromethane sulfonate, dinitrobenzyltosylate, n-decyl disulfone, naphthylimido trifluoromethane sulfonate and mixture thereof.

5

10. The photoresist composition according to claim 9, wherein the photoacid generator is selected from the group consisting of diphenyl iodide hexafluorophosphate, diphenyl iodide hexafluoroarsenate, diphenyl iodide hexafluoroantimonate, diphenyl p-methoxyphenyl triflate, diphenyl p-toluenyl triflate, diphenyl p-isobutylphenyl triflate, diphenyl p-tert-butylphenyl triflate, triphenylsulfonium hexafluorophosphate, triphenylsulfonium hexafluoroarsenate, triphenylsulfonium hexafluoroantimonate, triphenylsulfonium triflate, dibutyl-naphthylsulfonium triflate and mixture thereof.

10

11. The photoresist composition according to claim 8, wherein the photoacid generator is present in an amount ranging from about 0.1 to about 10% by weight of the photoresist polymer.

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12. The photoresist composition according to claim 8, wherein the organic solvent is selected from the group consisting of ethyl 3-ethoxypropionate, methyl 3-methoxypropionate, cyclohexanone, propyleneglycol methyl ether acetate, n-heptanone, ethyl lactate and mixture thereof.

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13. The photoresist composition according to claim 8, wherein an amount of organic solvent ranges from about 300% to about 1500% by weight of the photoresist polymer.

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14. A process for forming a photoresist pattern, comprising the steps of:

(a) coating a photoresist composition of claim 8 on a substrate of a semiconductor element to form a photoresist film;

(b) selectively exposing a portion of the photoresist film using a light source to form an unexposed portion of the photoresist film and leaving an unexposed portion of the photoresist film;

(c) applying silylating agent to the exposed portion photoresist film to produce a silylated layer on the top of the exposed portion of the photoresist film; and

(d) etching the non-exposed portion photoresist film using the silylated layer as an etching mask.

15. The process according to claim 14 further comprising pre-treating the substrate with hexamethyldisilazane before performing said step (a).

16. The process according to claim 14 further comprising a baking step before and/or after the exposure step (b).

17. The process according to claim 16, wherein the baking step or steps are performed at the temperature ranging from 70 to 200 °C.

18. The process according to claim 14, wherein the light source is selected from the group consisting of ArF, KrF, EUV, VUV, E-beam, X-ray and ion beam.

19. The process according to claim 14, wherein the irradiation energy is in the range of from 1 to 50mJ/cm<sup>2</sup>.

20. The process according to claim 14, wherein the silylation agent is selected from the group consisting of hexamethyldisilazane, tetramethyldisilazane and bis(dimethyl amino)dimethyl silane, bis(dimethyl amino)methyl silane, dimethylsilyl dimethylamine, dimethylsilyl diethylamine, trimethylsilyl dimethylamine,  
5 trimethylsilyl diethylamine, dimethylamino pentamethyldisilane and mixture thereof.

21. A semiconductor element manufactured with the process of claim 14.